N09a Optically-thick magnetorotational wind from WS 35 : theoretical modeling and photometric observation at 2 Hz using Tomo-e Gozen

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WS 35 is a newly identified stellar object in an infrared nebula. The spectroscopic observation indicates that WS 35 has a strong wind with a velocity of $v_\infty \sim 16,000\,\mathrm{km\,s^{-1}}$ and a mass loss rate of $\dot{M} \sim 3\times10^{-6}\,M_\odot\,\mathrm{yr^{-1}}$. Given the position in the HR diagram ($T_\mathrm{ph} \sim 20,000\,\mathrm{K}$ and $L_\mathrm{ph} \sim 3\times10^{38}\,\mathrm{erg\,s^{-1}}$) and the inferred small photospheric radius ($R_\mathrm{ph} \sim 0.1\,R_\odot$), WS 35 is likely a young-hot white dwarf, possibly a remnant of a double white dwarf merger. We here obtain a new steady wind solution of strongly-magnetized fast-spinning young-hot white dwarfs, where an optically-thick wind is launched powered by a nuclear burning on the surface of the degenerate core and then accelerated by the magnetic torque and pressure gradient. We show that the observed properties of WS 35 can be consistently explained by a massive white dwarf with a surface magnetic field of $B_* \sim 10^{8-9}\,\mathrm{G}$ and a spin angular frequency of $\Omega \sim 0.1\,\mathrm{s}$. Searching for sub-minute variabilities associated with such a fast spin, we conduct a photometric observation at 2 Hz for WS 35 using the *Tomo-e Gozen* camera onboard the Kiso Schmidt telescope. No variability is confirmed. We discuss the implications.